Available online at www.worldscientificnews.com

World Scientific News

WSN 87 (2017) 77-98 EISSN 2392-2192

Influence of Compensation, Work Experience, and Project Work on Career Success

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ABSTRACT

Many structural engineers claim that work experience plays a distinctive role in how well engineers drive their productivity. Compensation or salary also plays a distinctive role in how well engineers perform, based on the quantity of project worked delivered rather than on the time spent on the job, and is particularly beneficial for increasing engineer productivity. The main purpose of this study is to determine the influence of structural engineers' compensation, work experience and project worked on career success. This study also aims to (i) determine the type and number of work experience that a structural engineer has; (ii) ability to have knowledge on the structural project worked by a structural engineer; (iii) identify the type of workplace responsibility on the structural project (iv) understand the scope and the construction technology applies on the structural project; (v) determine the different type of projects worked by a structural engineer by groupings; (vi) establish a relationship between structural worked and compensation from work experience on career success of a structural engineer. The findings of the study revealed that structural engineers' work experiences in design management, managing construction, and teaching structural design are significantly influenced by structural engineer's compensation whereas, structural engineer's compensation does not have significant influence on structural engineers' structural project worked.

***Keywords*:** Buildings, career success, compensation, construction cost, construction technology, project worked, structural engineer, work experience

1. INTRODUCTION

A career in structural engineering is all about working, often in a team, to develop the constructions that shape the world. Structural engineers make a difference; they are people who enjoy innovation, a challenge, opportunities, responsibility, and excitement in a varied career. A career in structural engineering would see being involved in seeing through structural engineering projects from design stage to construction and completion.

In some cases, if the preliminary design work is completed, the size and shape of the building are set and the finishes are selected, the structural engineer can begin the meat of his/her work. Structural engineers tabulate the vertical loads from building materials, occupants and contents and select the appropriate sizes and strengths of supporting members from roofs and floors to columns to footings, structural engineers trace the path of vertical loads until they deliver them safely to the supporting soils. They establish and design to limits which prevent the wall finishes and ceilings from cracking. Structural engineers work with geotechnical engineers to limit the settlement of home owners so their investment does not have that sinking feeling. They check for "bounce" in floors so they feel comfortable walking on them. Wood, concrete, masonry, steel, aluminum, epoxies, light-gauge metals, composites - are a few of the materials that structural engineers use in their practice.

While vertical loads are important, "lateral" loads from high winds, earthquakes or retained soil are where structural engineers earn their keep. Using the applicable building code, they match forces with resisting elements from the peak of the roof to the bottom of the footings. Walls are checked to assure they support both the load from floors above but also the gusts from severe storm winds. Structures are bolted to their foundations to resist the lateral sliding forces of earthquakes. Basement walls are designed to span between floor levels against the fluid pressure of the soil. Through calculations, a structure becomes a logical proof - where all forces cancel.

The structural engineer is responsible for translating his/her calculations into construction drawings for the contractor to use (Addis, 2001). Plan views of the individual building levels are developed. Details of the various connections are created and cited on these plans. Specifications for the structural materials and required inspections are added to complete the work. If the mechanical engineer places a large air conditioning unit on the roof, we plan for its support. If the architect would like skylights, we provide the openings. No variation which affects the performance of the building escapes the structural engineer.

In the field, structural engineers assist the contractor by accommodating his/her preferred construction methods (Ganiron Jr, 2017). Although engineers endeavor to select the most efficient method during design, field conditions and economic factors influence every project. Proposed alternates are reviewed against job requirements, calculations and codes then approved or rejected on that basis. When problems or errors in assembly arise, the structural engineer reviews the on-site conditions then makes recommendations for corrections. Should a test from a material sample not come up to specifications, we decide if portions of the building should be reinforced or removed and replaced.

At the end of the job, the structural engineer has very little to look at again. The design he/she created is now covered with finishes. Should it perform to expectations, his/her name will rarely be remembered (Ganiron Jr, 2017). The satisfaction of transforming a concept into a tangible object which serves and shelters its occupants is their reward.

This study is to analyze the influence of structural engineers' compensation, work experience, and project work on career success.

2. RELATED LITERATURE AND STUDIES

2. 1. Structural Engineering as a Career

A career in structural engineering attracts those who wish to rise to the challenge of a creative profession and the many career challenges. If new high school graduates choose to pursue a career in structural engineering, he will turn dreams into reality and have an impact on every aspect of people lives. Every single building, every piece of the built environment has got a structure in it, ranging from where people live in houses and apartments, through to where they travel, railway stations and bridges and all another commercial, industrial and leisure buildings.

A structural engineer will first conceive a structure; considering strength, form, and function. Then they will choose appropriate materials - such as steel, concrete, brick or timber - calculating and checking to ensure that the construction will remain safe and serviceable for the length of its intended lifetime. They often specialize in one area of work, such as bridges and tunnels, buildings, or large constructions such as oil installations. If a building appears to be collapsing or subsiding, a structural engineer will suggest methods of improving the foundations and keeping the structure intact (Lawson, 2006).

As a structural engineer, he can also choose what type of career he wishes to pursue. He may wish to concentrate on design and work as a consultant, or focus on the construction process and work for a contractor, or perhaps have a mixture of both.

It is the engineer's job to analyses plans for new projects, taking into account factors such as how weight will be distributed, and where stresses and strains will occur in the structure. Structural engineers also decide which materials to use when planning the detailed design of a structure, depending on the various factors that arise during the design process.

According to the RVS Educational Trust's Group of Institutions (2009), structural engineering is at the heart of any developed or developing a country. Virtually everything that people see in the modern world involves a structure of some shape or form. These include a huge variety of buildings, bridges, railways, airports, water supply systems, water treatment plants, flood defense schemes, oil, and gas process plants and power stations. Many examples of construction that remain from the ancient world are also fine examples of structural engineering. Structural engineers help to make, shape and maintain the built environment. They are professionals who enjoy innovation, challenges, opportunities, responsibility, and excitement in a varied and very satisfying career. Structural engineering is a profession that provides a tremendous opportunity to make a real difference to peoples' lives and their environment.

2. 2. The Major Occupational Groupings (MOG)

Much of the structural engineer's job takes place on site, often outdoors, at the various stages of construction of public and private projects all means Structural engineers often closely with construction managers and has to be careful to avoid forming a relationship that could cloud their professional judgment.

The structural integrity of a building is based on sound engineering principles and the use of high-quality materials; no amount of amicability can keep the building standing without those things. Many noted that construction managers will argue for the integrity of their construction when the building codes do not meet (Ucol-Ganiron Jr et al., 2012).

Structural engineers have to be reproach at their jobs; too much is at stake for everyone involved. An unusual aspect of being a structural engineer is that an engineer has to understand the timing of construction projects better than construction manager himself. This is because random inspections and unsupervised tours through the construction site are critical for keeping builders honest and the public safe. If a structural engineer conducts ocular inspections at a time when construction is stalled, insignificant, or complete, he cannot tell whether the work was done properly without tearing down the building.

The Major Occupational Groupings (MOG) identified the tasks of structural engineers (Walker et al., 1982). These are: Studies projects, assesses broad requirements, examines sites and determines most suitable location for structure, calculate stresses and strains implicit in or affecting proposed structures, consults with other specialists regarding technical and aesthetic requirements or consults with clients, management and government authorities to secure approval of plans, designs structure and prepares cost estimates, working plans and specifications, specializes in structural design, erection, maintenance and repair of large industrial, commercial, public or residential buildings, prepares work schedules and directs to operations as work exceeds, and plans, organizes and supervises maintenance and repair work in existing structures.

Structural engineers have a keen eye for detail and a comprehensive understanding of building standards and that their job is difficult, important and rewarding one (Ganiron Jr, 2013).

2. 3. Work Experience

Research suggests that job tenure and total time in the one's occupation are positively related to career attainment (Schein, 2006). Along with the amount of experience may be relevant in predicting career success. Specifically, it is becoming more important for structural engineers to have structural design experience, design management experience, construction experience and teaching experience in structural design suggesting that organizations are more likely to reward and promote engineers who have these work experiences (Judge et al., 1995).

Structure design is an experience of withstanding stresses and pressures imposed through environmental conditions and human use. Structure design seeks to ensure the buildings and other structures do not deflect, rotate, vibrate excessively or collapse and that they remain stable. This experience examines the existing buildings and structures to test if they are structurally sound and still fit for purpose. Working in close partnership with architects and other professional engineers they help to design most structures, including houses, hospitals, office blocks, bridges, oil rigs, ships, and aircraft. It is the structural engineer’s responsibility to choose the appropriate materials, such as concrete, steel, timber, and masonry, to meet design specifications and they are often involved in inspecting the work and advising contractors. Figure 1 shows the work experience in structural engineering.

Figure 1. Work Experience in Structural Engineering

Design management experience encompasses the ongoing processes, business decisions, and strategies that enable innovation and create effectively-designed products, services, communications, environments, and brands that enhance the quality of life and provide organizational success (DMI, 2010), On a deeper level, design management seeks to link design, innovation, technology, management and customers to provide competitive advantage across the triple bottom line: economic, social/cultural, and environmental factors. It is the art and science of empowering design to enhance collaboration and synergy between “design” and “business” to improve design effectiveness.

Managing construction experience includes coordinate and supervises a wide variety of projects, including the building of all types of public, residential, commercial, and industrial structures, as well as roads, memorials, and bridges (Theiss, 2015). Either a general contractor or a construction manager will oversee the construction phase of a project, although a construction manager may also consult with the client during the design phase to help refine construction plans and control costs. Construction managers oversee specialized contractors and other personnel. They schedule and coordinate all construction processes so that projects meet design specifications. They ensure that projects are completed on time and within budget. Some managers may be responsible for several projects at once—for example, the construction of multiple apartment buildings. Projects may require specialists in everything from structural steel and painting to landscaping, paving roads, and excavating sites. Depending on the project, construction managers may interact with lawyers and local government officials. For example, when working on city-owned property or municipal buildings, managers sometimes confer with city inspectors to ensure that all regulations are met.

Teaching experience in a structural design for the students is the understanding of structural concepts, fundamental to the sound and innovative design of structures (buildings, bridges etc.) is even more important because of the wide use of computers and the, often unquestioning, reliance placed on the results of computer analyses which though correct in themselves may be based on incorrect assumptions and modeling (Ji et al., 2015). This is in line with criticisms from the construction industry that graduates tend to place over reliance on the use of computers. Graduates are generally good at using the laptop but many are unable to judge whether the results obtained from the laptop are correct, which indicates that students may not be made adequately familiar with basic structural concepts during their university studies.

2. 4. Structural Project Work

The members of the Association Structural Engineers of the Philippines (ASEP) measure their career success on the number and type of projects they worked. This shows the pride of a structural engineer and serves as a landmark of humanity. The National Structural Code of the Philippines (2015) defined the different type of projects worked by a structural engineer. These are Group 1- Simple structures such as lofts, warehouse, garages, sheds, market buildings, and comparable projects of one but not more than two stories. Group 2-Buildings of 3 stories up to 14 stories, towers, tanks, exhibition buildings, memorials, industrial buildings, simple bridges, low dams, piers, wharves, bins and silos and comparable projects. Group 3-Buildings with fifteen (15) or more floors, long span and complex bridges, high dams, major port works power plants and other complex structures not covered in Group 1and, Group 4: Hotels, large apartment buildings, office buildings, shopping centers, store buildings, resorts, hospitals and comparable projects simple structures. Figure 2 shows the type of projects worked by a structural engineer.

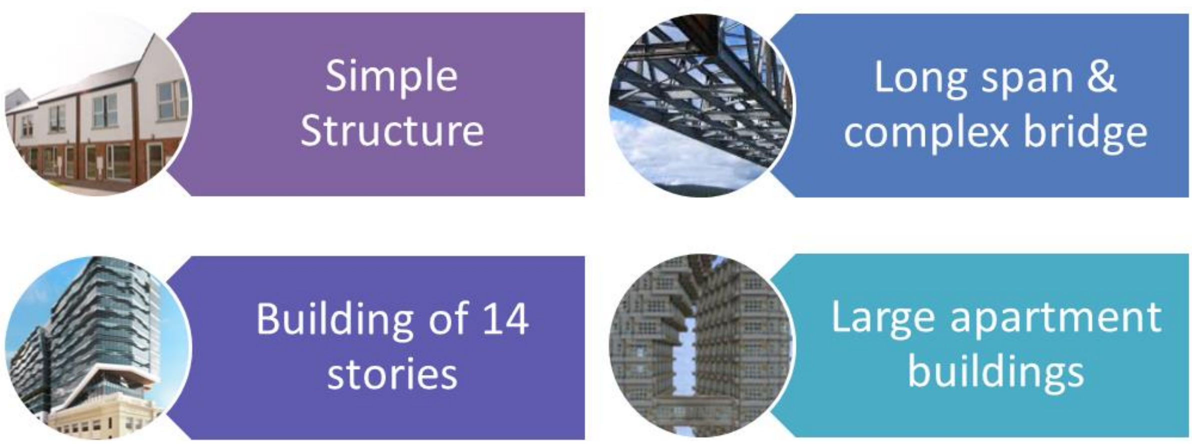


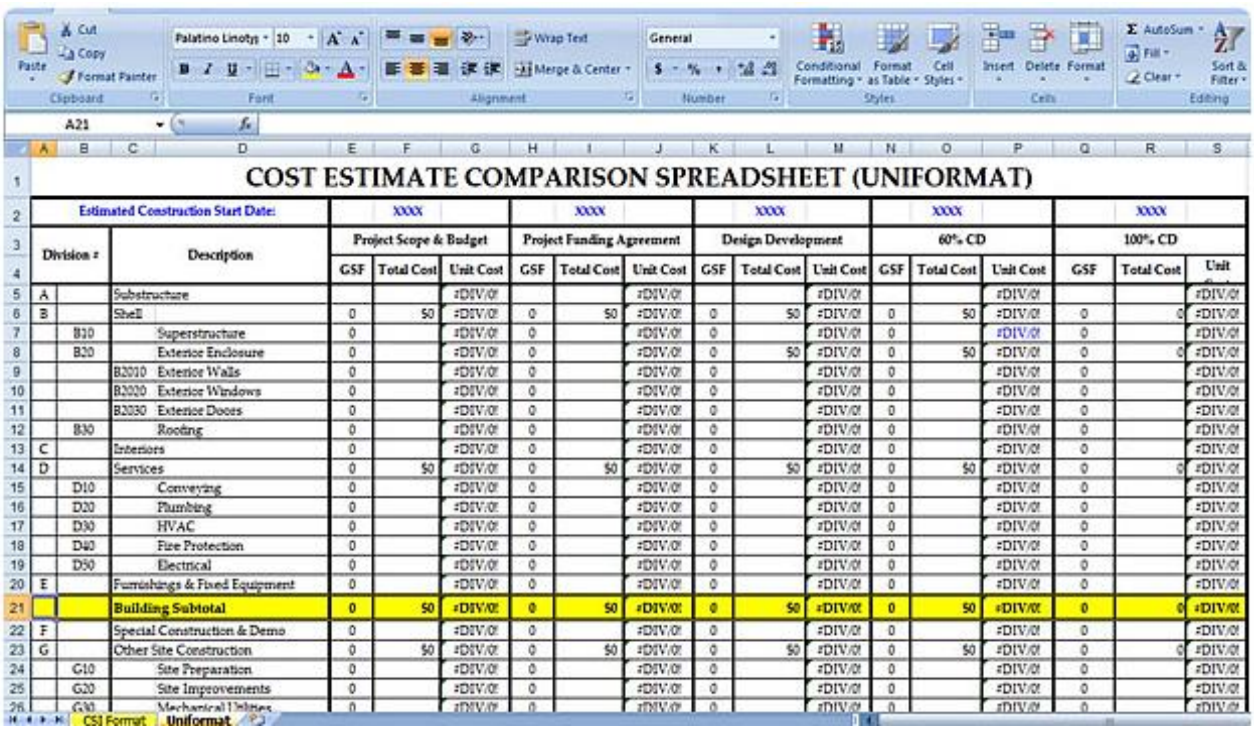
Figure 2. Type of Projects worked by a Structural Engineer

A type of work such as the design of structural members measures the creativity and innovation of an engineer through the use of different application of construction technology. On the other hand, the success of structural engineers depends on the construction cost of projects, responsibility, and scope of work (Manual of Professional Practice for Civil Engineers, 2001). These are indicators of the basic fees of an engineer. The responsibility of a structural engineer is the services contributed to the projects. The career successes of structural engineers are based on the number and types of structural projects designed. This shows the pride and creativity of a structural engineer and landmark of humanity (Gibson, 2004).

2. 5. Project Construction Cost

The costs of a constructed building to the owner include both the initial capital cost and the subsequent operation and maintenance costs. Each of these major cost categories consists of a number of cost components such as capital cost, and operation and maintenance cost. The magnitude of each of these cost components depends on the nature, size, and location of the project as well as the management organization, among many considerations. The owner is interested in achieving the lowest possible overall project cost that is consistent with its investment objectives.

It is important for design professionals and construction managers to realize that while the construction cost may be the single largest component of the capital cost, other cost components are not insignificant.



COST ESTIMATE COMPARISON SPREADSHEET (UNIFORMAT)

Division #			Description	GSF	Total Cost	Unit Cost	GSF	Total Cost	Unit Cost	GSF	Total Cost	Unit Cost	GSF	Total Cost	Unit Cost	GSF	Total Cost	Unit Cost
Estimated Construction Start Date:					XXXX			XXXX			XXXX			XXXX			XXXX	
				Project Scope & Budget			Project Funding Agreement			Design Development			60% CD			100% CD		
A			Substructure			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
B			Shell	0	$0	#DIV/0!	0	$0	#DIV/0!	0	$0	#DIV/0!	0	$0	#DIV/0!	0	0	#DIV/0!
	B10		Superstructure	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!
	B20		Exterior Enclosure	0		#DIV/0!	0		#DIV/0!	0	$0	#DIV/0!	0	$0	#DIV/0!	0	0	#DIV/0!
		B2010	Exterior Walls	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!
		B2020	Exterior Windows	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!
		B2030	Exterior Doors	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!
	B30		Roofing	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!
C			Interiors	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!
D			Services	0	$0	#DIV/0!	0	$0	#DIV/0!	0	$0	#DIV/0!	0	$0	#DIV/0!	0	0	#DIV/0!
	D10		Conveying	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!
	D20		Plumbing	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!
	D30		HVAC	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!
	D40		Fire Protection	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!
	D50		Electrical	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!
E			Furnishings & Fixed Equipment	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!
			Building Subtotal	**0**	**$0**	**#DIV/0!**	**0**	**$0**	**#DIV/0!**	**0**	**$0**	**#DIV/0!**	**0**	**$0**	**#DIV/0!**	**0**	**0**	**#DIV/0!**
F			Special Construction & Demo	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!
G			Other Site Construction	0	$0	#DIV/0!	0	$0	#DIV/0!	0	$0	#DIV/0!	0	$0	#DIV/0!	0	0	#DIV/0!
	G10		Site Preparation	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!
	G20		Site Improvements	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!
	G30		Mechanical Utilities	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!	0		#DIV/0!

Figure 3. A Sample of Cost Estimate Comparison Spreadsheet (UNIFORMAT)

For example, land acquisition costs are a major expenditure for building construction in high-density urban areas, and construction financing costs can reach the same order of magnitude as the construction cost in large projects such as the construction of nuclear power plants (Hendrickson et al., 1998). From the owner's perspective, it is equally important to estimate the corresponding operation and maintenance cost of each alternative for a proposed facility in order to analyze the life cycle costs. Figure 3 shows a sample of cost estimate comparison spreadsheet (UNIFORMAT).

The large expenditures needed for facility maintenance, especially for publicly owned infrastructure, are reminders of the neglect in the past to consider fully the implications of operation and maintenance cost in the design stage. In most construction budgets, there is an allowance for contingencies or unexpected costs occurring during construction ((Hendrickson et al., 1998). This contingency amount may be included within each cost item or be included in a single category of construction contingency. The amount of contingency is based on historical experience and the expected difficulty of a particular construction project.

Construction cost constitutes only a fraction, though a substantial fraction of the total project cost. However, it is the part of the cost under the control of the construction project manager. The required levels of accuracy of construction cost estimates vary at different stages of project development, ranging from ball park figures in the early stage to fairly reliable figures for budget control prior to construction. Since design decisions made at the beginning stage of a project life cycle are more tentative than those made at a later stage, the cost estimates made at the earlier stage are expected to be less accurate. Generally, the accuracy of a cost estimate will reflect the information available at the time of estimation.

Construction cost estimates may be viewed from different perspectives because of different institutional requirements. In spite of the many types of cost estimates used at different stages of a project, cost estimates can best be classified into three major categories according to their functions. A construction cost estimate serves one of the three basic functions: design, bid, and control. For establishing the financing of a project, either a design estimate or a bid estimate is used.

In the Philippines, the project construction range from 10PHP million to 30PHP million based in the NSCP (2015) different type of projects worked by a structural engineer according to groupings.

2. 6. Responsibility

The responsibility of the structural engineer is a key component in the construction process. Part of the wider discipline of structural engineering is concerned with the design and physical integrity of buildings and other large structures, like tunnels and bridges. Structural engineers have a wide range of responsibilities - not least a duty to ensure the safety and durability of the project on which they are working (New Civil Engineer Careers, 2017). Unlike architects, who must focus on the appearance, shape, size, and use of the building, structural engineers must solve technical problems - and help the architect achieve his or her vision for the project. Structural engineers work in offices and on construction sites - or may split their time between both contexts. Locations can be varied, including work in metropolitan and rural environments. Depending on the size of the project, structural engineers may also be required to work long hours - in teams consisting of professional, skilled and semi-skilled workers.

Many structural engineers deal primarily in the design of structures - calculating the loads and stresses the construction will have to safely withstand. Structural engineers should be able to factor in the different qualities and strengths delivered by a range of building materials and understand how to incorporate support beams, columns, and foundations. Before work can begin, structural engineers are involved in the investigation and survey of build sites to determine the suitability of the earth for the requirements of the upcoming project. Structural engineers will be required to coordinate and consult with other members of their projects, including engineers, environmental scientists, architects and landscape architects. They may also be required to assist government bodies in their own inspections relating to the project. Structural engineers are often responsible for the organization and delivery of materials and equipment for the needs of the construction project. The supervision and management of on-site labor may also be a necessity.

The success of the structural project will depend on the output responsibilities of overall project coordinator, design engineer, and architects. Figure 4 shows the project team roles and responsibilities. A project coordinator is the member of a project management team responsible for keeping the project organized and running smoothly. The project coordinator works alongside the project manager to track and dispense all of the information the various team members need to do their jobs effectively (Harrin, 2017). The project coordinator is responsible for keeping the Project coordinators must be flexible and adept at multitasking, as they are generally required to perform a wide variety of tasks on a daily basis, sometimes even simultaneously while the specific role of the project coordinator will vary somewhat from company to company, the following are tasks that project coordinators are typically expected to accomplish such as organize meetings, team celebrations; arrange for meetings between team members, and between team members and clients; record minutes at meetings; keep detailed project notes and records; develop project strategies; create project schedules; create task lists for team members; monitor project progress, budget, hours, etc. ; track and manage incoming paperwork; keep all members of the team up-to-date with current information and paperwork; and communicate with team members to ensure optimal strategy and maximum efficiency.

The Design Engineer will be responsible for carrying out the duties of the Engineering department, including design, research, prototyping, engineering documentation, estimating and process improvement. The Design Engineer report directly to the Lead Designer, and collaborate with design/purchasing and shop/assembly teams on design projects (Fish4jobs, 2017). This is an excellent opportunity to work in a friendly work environment with a team that is dedicated and passionate about craftsmanship and innovation. The responsibilities of the Design Engineer are to create models and drawings of products; research new materials and methods of development; organize and maintain existing engineering records; construct prototypes and confirm designs with design/purchasing team; perform physical testing on engineering prototypes; and ensure components and assemblies adhere to applicable industry and business standards.

In the design role, an architect is hired by a client to produce detailed designs of a concept or idea that the client wants to bring to reality. As well as needing creative design ideas, this part of the role involves a great deal of technical knowledge and responsibility (CITE, 2016). There is a need to comply with building and safety regulations, local planning regulations and restrictions. Depending on the project, there may be laws surrounding the preservation of the local environment or any historic parts of a building. Regular client meetings are important to establish requirements and discuss detailed design proposals. Also important is the team of professionals who will work on this stage of the project including engineers, designers, and financiers. During the documentation phase, the responsibilities are to capture the design on paper, producing detailed drawings and using technology such as CAD to test the feasibility of the design. This stage can involve continual revision and redraw to incorporate changes based on the client's requirements, budget and regulations. Once the design documents are complete, there are then the second sets of documents that need to be produced. These are the construction documents, which translate the design into instructions and technical specifications for contractors and construction experts. Once the project reaches the construction stage, the architect will be involved in site visits and meetings, overseeing the construction and signing off on various pieces of work, negotiating with contractors and dealing with and resolving any problems that arise.

Figure 4. Project Team Roles and Responsibilities

2. 7. Scope of Structural Projects

The scope of a project is the sum total of all of a project's products and their requirements or features (Watkins et al., 2010). Sometimes the term scope is used to mean the totality of work needed to complete a project. In traditional project management, the tools to describe a project's scope (product) are the product breakdown structure and product descriptions. The primary tool to describe a project's scope is the Work Breakdown Structure (WBS).Extreme project management advocates the use of user stories, feature lists and feature cards to describe a project's scope (product-deliverable).If requirements are not completely defined and described and if there is no effective change control in a project, scope or requirements creep may ensue.

The Scope of a structural project is divided into the four basic types (NSCP, 2015) shown in figure 5. These are the new construction, maintenance and repair, alteration and addition, and renovation/retrofit.

New construction refers to the construction of completely new buildings or structures. This is also the architecturally attached to an existing building that should be considered an addition rather than the new construction even though the new building is not attached structurally (DGS General Services, 2016). Buildings that are attached by walkway covers should be listed as separate buildings on the application form even though they may be structurally attached to the walkway cover.

Figure 5. Scope of a Structural Project

Additions refer to the new construction adds floor area (or covered area such as canopies or shade structures) that is attached to an existing building while alterations consist of any construction that modifies an existing building or structure without adding new covered area (DGS General Services, 2016). Modernizations, upgrades, modifications and other projects of this type are considered alterations. Rehabilitation is an alteration to a building or buildings which do not conform to current code, to bring the building into compliance with current code requirements. Maintenance, repair, and operations involve fixing any sort of mechanical plumbing, or electrical device should it become out of order or broken (known as repair, unscheduled, casualty or corrective maintenance).

Renovation, retrofit, and refurbishment of existing buildings represent an opportunity to upgrade the energy performance of commercial building assets for their ongoing life (E3i, 1997). Often retrofit involves modifications to existing buildings that may improve energy efficiency or decrease energy demand. In addition, retrofits are often used as an opportune time to install distributed generation to a building. Energy efficiency retrofits can reduce the operational costs, particularly in older buildings, as well as help to attract tenants and gain a market edge.

2. 8. Construction Technology

With the passage of time, the construction industry has passed through advancements. One of them is the emphasis on designing buildings before practically constructing these buildings. Technological progress has introduced many innovations in the field of construction industry. The construction of a building is dependent on the level of construction technology. The NSCP (2015) enumerate that a building can be applied using construction technology in a structural project worked. As shown in figure 6, these are concrete building, composite building, and steel framed building.

Ponomarev (2017) has developed several types of building blocks for a concrete building based on nanostructured high-strength lightweight concrete reinforced with skew-angular composite coarse grids. The development has unique characteristics, enabling the increase of load-carrying capability by more than 200 percent and a decrease in specific density of the construction by 80 percent. In addition, the blocks are resistant to corrosion, aggressive environments, and excessive frost resistance. Researchers calculated that the service life of the concrete building structures made this reinforcement system will increase at least two to three times in comparison with its modern analogs.

Figure 6. Level of Construction Technology in a Structural Project

According to the Eenstruct services, the result of the development of technology in building construction is the composite structures. The structural elements are composed of steel and reinforced concrete. With the cooperation of the two materials meet all the criteria of functionality and durability over time. This modern method of construction has comparative advantages: increased completion speed of the building, best value to quality ratio, maximum seismic protection, and improved aesthetics.

On the other hand, a steel frame is a building technique with a "skeleton frame" of vertical steel columns and horizontal I-beams, constructed in a rectangular grid to support the floors, roof, and walls of a building which are all attached to the frame (Toukan, 2017). The development of this technique made the construction of the skyscraper possible. The frame needs to be protected from a fire because steel softens at high temperature and this can cause the building to partially collapse. In the case of the columns, this is usually done by encasing it in some form of fire resistant structure such as masonry, concrete or plasterboard. The beams may be cast in concrete, plasterboard or sprayed with a coating to insulate it from the heat of the fire or it can be protected by a fire-resistant ceiling construction. Asbestos was a popular material for fireproofing steel structures up until the early 1970s before the health risks of asbestos fibers were fully understood. The exterior "skin" of the building is anchored to the frame using a variety of construction techniques and following a huge variety of architectural styles. Bricks, stone, reinforced concrete, architectural glass, sheet metal and simply paint have been used to cover the frame to protect the steel from the weather.

2. 9. Compensation and Career Success

Structural Engineers are well paid. In 2014, civil engineer graduates in the Philippines receive the highest starting salary of any discipline. The average pay for a Structural Engineer is PHP 294,791 per year. Skills that are associated with high pay for this job are Microsoft Excel and AutoCAD. Most people move on to other jobs if they have more than 10 years' experience in this field.

In other foreign countries, there are new insights into how structural engineer view career success; a continuing high rate of job satisfaction; and a persistent gender gap in salaries. The largest such international study of the construction industry found a median salary of US $73,000, with salaries widely distributed around this midpoint and differences primarily driven by country income level, employer type, and primary job type. Median salaries for structural engineers in Sweden, Canada, Australia, Germany, Netherlands, Israel, USA, and Switzerland were more than that, with the Swiss median reaching the US $124,599.

Researchers suggest that salary is the most widely used and readily accessible indicators of extrinsic career success (Hall et al., 2005). These extrinsic measures can have the substantial benefits of being readily available from existing records, standardized at least within firms, and efficient to collect. They are free from self-serving and common-method variance if collected by means other than self-support. They are valued by many engineers and executives (Schneer et al., 2003). Structural engineers motivate their career on visible metrics of advancement in status, responsibility, salary, and authority. (Vries et al., 1992).

Salary is the most widely used and readily accessible indicators of career success (Seibert, 1999). This objective measures can have the substantial benefits of being readily available from existing records, standardized and efficient to collect. They are free from self-serving and common-method variance, if collected other than self-support. They are valued by many people, as anecdotally, reflected by Zig Ziglar's (1997) quip that: "Folks who say they do not care about money will probably lie about other things too!" Extrinsic criteria of career success have limited meaning in the many jobs where pay is institutionalized, such as the military engineer.

The deficiency of traditional extrinsic criteria, such as pay, stems from the fact that this is not only extrinsic outcomes that people seek from their careers. For instance, teachers in structural engineering frame their career success in terms of hard data on the learning and other attainments of their students and protégées. Even when continual attainment of such extrinsic outcomes does not lead to an increase in pay their value as objective indicants of career success is not necessarily diminished.

Receiving high pay do not necessarily people feel proud or successful (Korman et al., 1981). In fact, they can cause work and personal; alienation described how newly appointed construction managers who do not delegate adequately can soon become overwhelmed and depressed, potentially leading to both intrinsic and extrinsic career failure. Such evidence that intrinsic success is not necessarily a function of extrinsic attainments highlights the importance of learning more about the nature of intrinsic career success, as well as the causal relationship between different extrinsic and intrinsic career outcomes.

3. RESEARCH DESIGN AND INSTRUMENTATION

3. 1. Research Design

The use of the descriptive research method in the study involved the presentation, analysis, and interpretation of the assessed (both the preferred and the actual) the type of work experiences, level of compensation and the kind of structural project work of a structural engineer as perceived by the selected category AAA constructor of PCAB. After describing the factors, these were correlated with the type of work experiences and the kind of structural project work.

The subjects of this study were the selected category AAA constructor of PCAB that are presently engaged in General Engineering. A sample of 110 respondents was used in this study. Purposive sampling was adopted using the following criteria as guide in the selection of respondents: (1) Registered Civil Engineer regularly and extensively engaged in the practice of structural engineering for at least five years, (2) A degree of Master of Science in engineering major in structures or a doctorate degree in Civil Engineering with structures as the specialization, and (3) Active Member of the Association Structural Engineer of the Philippines (ASEP).

3. 2. Instrumentation

The major tool for data gathering was the questionnaire. The questionnaire was divided into 2 parts. The first part dwelt on the type of work experience gained by the structural engineer. The second part focused on the level of compensation and project work of a structural engineer.

The Manual of Structural Engineers of the Philippines was the basis of structural projects including the type of building worked, project construction cost, the role of structural engineers in a project, scope of work and construction techniques applied in buildings.

Work experiences were measured through four distinct variables: (1) structural design, (2) design management, (3) managing construction and, (4) teaching design subjects. The structural project worked was measured through four distinct variables: (1) average project construction cost, (2) responsibility, (3) scope of structural projects and, (4) construction technology. Compensation was measured through four distinct variables: (1) less than PHP 30,000, (2) PHP 51,000 to PHP 60,000, (3) PHP 30,000 to PHP 40,000, (4) PHP 41,000 to PHP 50,000 and, (5) more than PHP 60,000).

After the retrieval of the questionnaire, the data were encoded and entered into the master list. Data analysis was done using the percentage score, mean and correlation analysis

4. PRESENTATION, ANALYSIS, AND INTERPRETATION OF DATA

4. 1. Work Experience

As shown in table 1, the number of work experience in structural design, design management, managing construction and teaching design subjects ranged not less than 5 years to 20 years.

Table 1. Frequency and Percentage Distribution of Structural Engineers by Type of Worked Experience

Type of Worked Experience	Frequency	Percentage
Structural Design		
Less than 5 years	60	54.3
Between 5 to 10 years	15	13.6
Between 10 to 15 years	14	12.7
Between 16 to 20 years	21	19.1
Total	110	100
Design Management		
Less than 5 years	66	60
Between 5 to 10 years	15	13.6
Between 10 to 15 years	14	12.7
Between 16 to 20 years	21	13.6
Total	110	100
Managing Construction		
Less than 5 years	66	60
Between 5 to 10 years	19	17.3
Between 10 to 15 years	6	5.5
Between 16 to 20 years	19	17.3
Total	110	100
Teaching Structural Design		
Less than 5 years	52	47.3
Between 5 to 10 years	14	12.7
Between 10 to 15 years	30	27.3
Between 16 to 20 years	14	12.7
Total	110	100

The majority of the structural engineers have less than 5 years' work experience both design management and managing construction (60%), structural design (54.5%) and teaching design subjects (47.3%). Moreover, structural engineers have 5 to 10 years work experience in managing construction (17.3%), both design management and structural design (13.6%) and teaching design subjects (12.7%).

Structural engineers have 11 to 15 years work experience in teaching design subjects (27.3%), both structural design and design management (12.7%) and managing construction (5.5%) and finally, structural engineers have 16 to 20 years work experience in structural design (19.1%), managing construction (17.3%), design management(13.6%) and teaching design subjects (12.7%). Hence, structural engineers were dominated by less than 5 years worked experiences in design management and managing construction in the construction industry.

4. 2. Structural Project Worked

Average Project Construction Cost: Respondents were given two or more choices to indicate the type of structural project worked for the last two years including the average project construction cost, responsibility in the projects, scope of structural projects and construction techniques used in the projects. As shown in table 2, the respondents has an average project construction cost P 10M and less than in Group 2- Buildings of 3 stories up to 14 stories, towers etc. (33.6%), both Group 1-Simple Structures but not more than 2 stories and Group 3- Buildings with 15 or more floors (30.9%), and Group 4-Hotels, large apartment buildings, office buildings, etc. (17.3%). Moreover, the average project construction cost over P 10M to P 20M in Group 4 (30.9%), Group 3 (27.3%), Group 2 (20.9%) and Group 1 (16.4%). Another project construction cost over P 20M to P 30M in Group 4 (27.3%), Group 1 (20.9%), Group 3 (17.3%) and Group 2 (15.5%). Finally, project construction cost over 30M in Group 1 (31.8%), Group 2 (30%) and both Group 3 and Group 4 (24.5%)

Responsibility: Majority of the responsibility of structural engineers in their projects have an overall coordinator in Group 2 (50.9%), Group 3 (50%) and Group 1 (47.3%) unlike in Group 4 (39.1%) focus in basic engineering design. Very few structural engineers' responsibility their projects have an overall coordinator in Group 2 (28.2%) and Group 3 (29.1%). Moreover, few structural engineers concentrated in over-all coordinator in Group 4 (37.3%).

The Scope of Structural Projects: These are maintenance and repair, alteration and addition, and renovation/retrofitting in Group 4 (71%), Group 1(58.1%), Group 2 (53.6%), and Group 3 (50.9%). Very few structural engineers' scope of projects is new in Group 1 (41.8%), Group 2 (46.4%), Group 3 (49.1%) and Group 4 (29.1%).

Construction Technology: The construction technology used by the structural engineer in their projects are concrete building, composite building, and steel frame building.

The majority of structural engineers used composite building in Group 1 (50%), Group 3 (48.2%), and Group 2 (34.5%).Moreover, structural engineers are more concentrated to used steel frame building in Group 4 (37.3%) Some of the structural engineers used concrete building in Group 2 (31.8%) and composite building in Group 4 (32.7%).

Very few structural engineers used steel frame building in Group1 (22.7%) and Group 3 (17.3%). Most structural engineers are in charge of overall coordination including architectural and other engineering design in between buildings of 3 stories and up to 15 stories including hotels, large apartment buildings and other comparable projects with an average project construction cost between 10M and up to 30M using composite building technology and the scope of their project work are maintenance and repair, alteration and addition, and renovation/retrofit.

Moreover, structural engineer possesses a high degree level of skills in innovation and creativity. They are fraught with engineering challenged and this became their pride to humankind and major achievement.

The level of their opportunities, responsibility, and excitement are very high since all of their structural projects presented are more than 15 stories. In the Manual of Professional Practice of Structural Engineers (2005), structural engineers who are in charge of overall coordinator both architectural and engineering services for 15 stories buildings or more with a project construction cost over 30M received a minimum compensation of P 2,200,000 plus 5.5% in excess of P 30M.

Table 2. Frequency and Percentage Distribution of Structural Engineers by Structural Project Worked

Structural Project Worked	Group 1		Group 2		Group 3		Group 4	
	f	%	f	%	f	%	f	%
Project Construction Cost								
P 10M and less than	34	30.9	37	33.6	34	30.9	19	17.3
Over P 10M to P 20M	18	16.4	23	20.9	30	27.3	34	30.9
Over P 20M to P 30M	23	20.9	17	15.5	19	17.3	30	27.3
Over P 30M	35	31.8	33	30	27	24.5	27	24.5
Total	110	100	110	100	110	100	110	100
Responsibility								
Overall coordinator	52	47.3	56	50.9	55	50	41	37.3
Engineering Design	21	19.1	31	28.2	32	29.1	43	39.1
Architect	37	33.6	23	20.9	23	20.9	26	23.6
Total	110	100	110	100	110	100	110	100
Scope of structural projects								
New	46	41.8	51	46.4	54	49.1	32	29.1
Maintenance and Repair	25	22.7	29	26.4	25	22.7	33	30
Alteration and addition	24	21.8	14	12.7	18	16.4	28	25.5
Renovation/Retrofitting	15	13.6	16	14.5	13	11.8	17	15.5
Total	110	100	110	100	110	100	110	100
Construction technology								
Concrete Building	30	27.3	35	31.8	38	34.5	33	30
Composite Building	55	50	38	34.5	53	48.2	36	32.7
Steel frame Building	25	22.7	37	33.6	19	17.3	41	37.3
Total	110	100	110	100	110	100	110	100

Therefore, the level of engineering services fees received by structural engineers for every project is highly competitive with regards to the number of stories and project construction cost.

4. 3. Compensation

More than one-third of the respondents, 36.4% earned an average monthly compensation PHP 41,000 to PHP 50,000. There are also 23.6% earned an average monthly compensation more than P60,000, 22.7% earned an average monthly compensation PHP 30,000 to PHP 40,000, 9.1% earned an average monthly compensation PHP 51,000 to PHP

60,000 and 8.2% earned an average monthly compensation less than PHP 30,000. Generally, structural engineers received high average monthly compensation.

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Table 4. Frequency and Percentage Distribution of Structural Engineers by Compensation

Average Monthly Compensation	Frequency	Percentage
less than P 30,000	9	8.2
P 30,000-P40,000	25	22.7
P 41,000-P50,000	40	36.4
P 51,000-P60,000	10	9.1
More than P60,000	26	23.6
Total	110	100

4. 4. Correlation between the factors of career success (structural worked and compensation) and work experience

Structural design experience was also found to have no relationship to compensation with a correlation value of 0.001 shown in table 5. The finding implies that work experience in structural design is not significant to compensation. This means that work experience in structural design has nothing to do with compensation. Regardless of work experience in structural design, every structural engineer is expected to be experts in structural design since this is the foundation of the structural engineering profession. Generally, structural engineers who have been promoted for the first time in their career with an experience in structural design. With work experience in design management, it was found to have a relationship to compensation with a correlation value of 0.285 in compensation. The finding implies that work experience in design has a relationship to compensation. Generally, structural engineers who have work experience in design management are promoted in administrative levels. They received higher compensation and more fringe benefits.

Table 5. Correlation between the factors of career success (structural worked and compensation) and work experience

Type of Work Experience	Factors of Career Success	Correlation Value (r)	Sig	Decision of Ho	Interpretation
Structural Design	Compensation Structural projects	0.001 0.036	0.146 0.508	Accepted Accepted	Not Significant Not Significant
Design Management	Compensation Structural projects	0.248 0.076	0.005 0.081	Rejected Accepted	Significant Not Significant
Managing Construction	Compensation Structural projects	0.215 0.079	0.012 0.091	Rejected Accepted	Significant Not Significant
Teaching	Compensation Structural projects	0.234 -0.001	0.007 0.299	Rejected Accepted	Significant Not Significant

Work experience in managing construction was also found to have a correlation value of 0.215 in compensation. The finding implies that work experience in managing construction has a relationship to compensation. Generally, structural engineers who have experience in managing construction are managers. They received higher monthly average compensation. Regardless of fringe benefits, construction managers and project managers should stay more years in their current company to receive more fringe benefits.

Teaching design experience was found 0.234 correlation value, in compensation. The finding implies that compensation is significant at 0.05 levels. In the 201 file, most structural engineers who are promoted in the company earned higher compensation and possess good communication skills and public relations. This skills and values were developed through work experience in teaching design subjects. Regardless of fringe benefits, structural engineers who have experience in design subjects should stay more years in their current company to receive more fringe benefits.

Finally, the type of work experience does not influence the projects of structural engineers; hence they have no relation to structural project worked.

5. CONCLUSIONS

The results reveal that work experience in design management, managing construction, and teaching structural design are important factors affecting structural engineers' compensation. Working in the fields of design management, managing construction, and teaching structural design requires a Master's degree or Ph.D. degree and often at least 5 years of experience working in the field to obtain the position. Most of the design manager and construction manager spent working inside of an office work space, planning and overseeing projects that are being handled by various teams. Construction managers are also known to work within laboratories, construction sites themselves and industrial plants depending on the type of project that has been taken on. Working in engineering, architecture and research and development are all sectors of the job when working professionally and full-time as a design manager and construction manager. On the other hand, teaching structural design must contribute to expanding the field consistently in order to be held in such esteem. They work by dividing up enough time to write books, conduct research, meet with graduate and undergraduate students, attend departmental meetings and events, and grade the work of 45-100+ students' work per semester.

Employers regard work experience as an indicator of performance in a similar role or industry. Thus, work experience affects the ability of individuals to get a job, affects their starting salary, and plays a role in determining increments and promotions.

Compensation is the output that structural engineers' received in the form of pay, wages and also same rewards like a monetary exchange for the structural engineers' to increases their performance in working structural projects. Compensation is the segment of transition between the structural engineers' and the employer that the outcomes employee contract. As the perspective of structural engineers' pay is the necessity of life.

The researcher suggests that an employer may rate a structural engineers' compensation relative to his/her type of work experience. A poorly performing structural engineer may be given the same compensation as an average performing veteran structural engineer. Thus, compensation may attenuate work experience level differences by more compensation. This attenuation could explain the correlations found between work experience and compensation.

However, the results show that structural engineer' work experience does not influence the projects of structural engineers. Hence, structural engineer' work experience have no relation to structural project worked in terms of career success. Some structural engineer feels satisfied with challenging and fascinating structural projects, which gives him/her with prestige. Along these lines, work experience considerably affects compensation and satisfaction. The researcher contends that structural engineer will feel joy and satisfaction from works under states of moderate challenging.

Future research is needed to examine the relationship between various measures of work experience of structural engineers in the Philippines

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(Received 05 September 2017; accepted 23 September 2017)